AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings of claims in the application.

LISTING OF CLAIMS:

1. (Canceled)

2. (Canceled)

3. (Currently Amended) A method in a computer graphics system for rendering and displaying on an output device, having a finite number of pixels, a non-zero thickness line segment with reduced aliasing, comprising:

expanding an edge of the line segment touching but not covering a pixel center of the line segment to be rendered on the output device so that the expanded line segment covers the center of the pixel touched;

determining, using the pixel centers, the pixels to be included in the expanded line segment, the line segment being distinguishable from a background over which said line segment is rendered by having a shade different from a shade of the background; [[and]]

for each pixel that is included in said non-zero thickness expanded line segment, determining the area of the pixel partially or fully covered by said line segment, and based on the area of the pixel covered, determining a shading value for the pixel by interpolating between the shade of said line segment and the shade of the background; and

displaying on the output device the reduced-aliased line segment;

wherein the output device has a x-y coordinate system established thereon and the pixels of the output device each have centers with an x-y coordinate;

wherein an edge of said line segment has an equation $ax + by + c = 0$; and

wherein the step of expanding an edge includes altering the equation of an edge of said line segment by adding an amount $(|a|+|b|)/2$ to the c parameter of the equation,

where a, b and c are coefficients of the equation $ax + by + c = 0$ of the edge of the line segment.

4. (Canceled)

5. (Currently Amended) A method in a computer graphics system for rendering and displaying on an output device, having a finite number of pixels, a non-zero thickness line segment with reduced aliasing, comprising:

expanding an edge of the line segment touching but not covering a pixel center of the line segment to be rendered on the output device so that the expanded line segment covers the center of the pixel touched;

determining, using the pixel centers, the pixels to be included in the expanded line segment, the line segment being distinguishable from a background over which said line segment is rendered by having a shade different from a shade of the background; [[and]]

for each pixel that is included in said non-zero thickness expanded line segment, determining the area of the pixel partially or fully covered by said line segment, and based on the area of the pixel covered, determining a shading value for the pixel by interpolating between the shade of said line segment and the shade of the background; and

displaying on the output device the reduced-aliased line segment;

wherein the output device has a x-y coordinate system established thereon and the pixels of the output device each have centers with an x-y coordinate;

wherein an edge of an expanded line segment has an equation describing the edge; and

wherein the step of determining the pixels to be included in the non-zero thickness line includes:

evaluating the equation of an edge of said expanded line segment with the x and y-coordinates of the center of each pixel; and

testing whether the result of the computation is greater than or equal to zero; and

wherein evaluating the equation of an edge of said expanded line segment with the x and y-coordinates of the center of each pixel includes computing $ax_0 + by_0 + c + (|a|+|b|)/2$, where x_0 and y_0 are the coordinates of the pixel center and a, b and c are coefficients of the equation $ax + by + c = 0$ of the edge of the line segment.

6. (Canceled)

7. (Currently Amended) A method in a computer graphics system for rendering and displaying on an output device, having a finite number of pixels, a non-zero thickness line segment with reduced aliasing, comprising:

expanding an edge of the line segment touching but not covering a pixel center of the line segment to be rendered on the output device so that the expanded line segment covers the center of the pixel touched;

determining, using the pixel centers, the pixels to be included in the expanded line segment, the line segment being distinguishable from a background over which said line segment is rendered by having a shade different from a shade of the background; and

for each pixel that is included in said non-zero thickness expanded line segment, determining the area of the pixel partially or fully covered by said line segment, and based on the area of the pixel covered, determining a shading value for the pixel by interpolating between the shade of said line segment and the shade of the background; and

displaying on the output device the reduced-aliased line segment;

wherein the output device has a x-y coordinate system established thereon and said line segment has a slope factor *sf* related to the slope of said line segment and a parameter *p* proportional to an x-distance between an edge of said line segment traversing a pixel and a pixel boundary; and

wherein, for an edge of said line segment that traverses a partially covered pixel so as to define a triangular area, the step of determining the area of a partially covered pixel includes:

determining that the area covered is less than or equal to a first predetermined limit; and

computing the triangular area covered by said line segment.

8. (Currently Amended) A method for rendering and displaying a non-zero thickness line as recited in claim 7,

wherein the parameter *p* is equal to the product of the slope factor *sf* and the distance between an edge of said line segment traversing the pixel and a pixel boundary;

wherein the line segment has a slope *m* and the slope factor *sf* equals $m/(m+1)$; and

wherein the step of computing the triangular area covered by said line segment includes forming a product $\frac{1}{2} * p^2 * (1-sf)^{-1} * sf^{-1}$ to find the area.

9. (Currently Amended) A method in a computer graphics system for rendering and displaying on an output device, having a finite number of pixels, a non-zero thickness line segment with reduced aliasing, comprising:

expanding an edge of the line segment touching but not covering a pixel center of the line segment to be rendered on the output device so that the expanded line segment covers the center of the pixel touched;

determining, using the pixel centers, the pixels to be included in the expanded line segment, the line segment being distinguishable from a background over which said line segment is rendered by having a shade different from a shade of the background; and

for each pixel that is included in said non-zero thickness expanded line segment, determining the area of the pixel partially or fully covered by said line segment, and based on the area of the pixel covered, determining a shading value for the pixel by interpolating between the shade of said line segment and the shade of the background; and

displaying on the output device the reduced-aliased line segment;

wherein the output device has an x-y coordinate system established thereon and said line segment has a slope factor *sf* related to the slope of said line segment and a parameter *p* proportional to an x-directed distance between an edge of said line segment traversing a pixel and a pixel boundary; and

wherein, for an edge of said line segment that traverses a partially covered pixel so as to define a maximum triangular area and a parallelogram area, the step of determining the area of a partially covered pixel includes:

determining that the area covered is greater than a first predetermined limit;

computing the maximum triangular area covered by said line segment;

computing the area of a parallelogram covered by said line segment; and

computing the sum of the maximum triangular area and the parallelogram area.

10. (Currently Amended) A method for rendering and displaying a non-zero thickness line as recited in claim 9, wherein the slope factor *sf* equals $m/(m+1)$, where m is the slope of said line segment.

11. (Currently Amended) A method for rendering and displaying a non-zero thickness line as recited in claim 9, wherein the p parameter equals the product of said x-directed distance and the slope factor sf.

12. (Currently Amended) A method for rendering and displaying a non-zero thickness line as recited in claim 11, wherein said x-directed distance is computed as the quotient $ax_0+by_0 + c + (|a|+|b|)/2$ and a, where x_0 and y_0 are the coordinates of the center of the pixel and the line segment edge has an equation $ax+by+c=0$ and a, b and c are coefficients of the equation.

13. (Currently Amended) A method for rendering and displaying a non-zero thickness line as recited in claim 9, wherein the first predetermined limit is the maximum[[area]] triangular area covered by said line segment traversing through the pixel.

14. (Currently Amended) A method for rendering and displaying a non-zero thickness line as recited in claim 9, wherein the step of computing the maximum triangular area covered by said line segment includes forming a product $\frac{1}{2} * (1-sf) * sf^{-1}$ to find the maximum triangular area.

15. (Currently Amended) A method for rendering and displaying a non-zero thickness line as recited in claim 9, wherein the step of computing the parallelogram area covered by said line segment includes forming a sum of $p*sf^{-1}$ and $(1-sf^{-1})$ to find the parallelogram area.

16. (Currently Amended) A method in a computer graphics system for rendering and displaying on an output device, having a finite number of pixels, a non-zero thickness line segment with reduced aliasing, comprising:

expanding an edge of the line segment touching but not covering a pixel center of the line segment to be rendered on the output device so that the expanded line segment covers the center of the pixel touched;

determining, using the pixel centers, the pixels to be included in the expanded line segment, the line segment being distinguishable from a background over which said line segment is rendered by having a shade different from a shade of the background; and

for each pixel that is included in said non-zero thickness expanded line segment,

determining the area of the pixel partially or fully covered by said line segment, and based on the area of the pixel covered, determining a shading value for the pixel by interpolating between the shade of said line segment and the shade of the background; and

displaying on the output device the reduced-aliased line segment;

wherein, for an edge of said line segment that traverses a partially covered pixel, the step of determining the area of a partially covered pixel includes:

determining that the area covered is greater than a second predetermined limit, leaving a triangular area not covered;

computing the triangular area not covered by said line segment; and

computing the difference between unity and the triangular area not covered to find the area of the pixel covered.

17. (Currently Amended) A method for rendering and displaying a non-zero thickness line as recited in claim 16, wherein the second predetermined limit is the sum of the maximum triangular area and the maximum parallelogram area of said line segment traversing the pixel.

18. (Currently Amended) A method for rendering and displaying a non-zero thickness line as recited in claim 16,

wherein the line segment has a slope m and the slope factor sf equals $m/(m+1)$ and the parameter p is equal to the product of the slope factor sf and the distance between an edge of said line segment traversing the pixel and a pixel boundary; and

wherein the step of computing the triangular [[not]]area not covered by said line segment includes forming a product $\frac{1}{2} * p^2 * (1-sf)^{-1} * sf^{-1}$ to find the triangular area not covered.

19. (Currently Amended) A method in a computer graphics system for rendering and displaying on an output device, having a finite number of pixels, a non-zero thickness line segment with reduced aliasing, comprising:

expanding an edge of the line segment touching but not covering a pixel center of the line segment to be rendered on the output device so that the expanded line segment covers the center of the pixel touched;

determining, using the pixel centers, the pixels to be included in the expanded line segment, the line segment being distinguishable from a background over which said line segment is rendered by having a shade different from a shade of the background; and

for each pixel that is included in said non-zero thickness expanded line segment, determining the area of the pixel partially or fully covered by said line segment, and based on the area of the pixel covered, determining a shading value for the pixel by interpolating between the shade of said line segment and the shade of the background; and

displaying on the output device the reduced-aliased line segment;

wherein when two parallel edges of said line segment traverse a partially covered pixel, the step of determining the area of the partially covered pixel includes:

computing a first area of the pixel not covered by the first parallel edge;

computing a second area of the pixel not covered by the second edge; and

summing the first and second areas and subtracting the sum from one.

20. (Currently Amended) A method in a computer graphics system for rendering and displaying on an output device, having a finite number of pixels, a non-zero thickness line segment with reduced aliasing, comprising:

expanding an edge of the line segment touching but not covering a pixel center of the line segment to be rendered on the output device so that the expanded line segment covers the center of the pixel touched;

determining, using the pixel centers, the pixels to be included in the expanded line segment, the line segment being distinguishable from a background over which said line segment is rendered by having a shade different from a shade of the background; and

for each pixel that is included in said non-zero thickness expanded line segment, determining the area of the pixel partially or fully covered by said line segment, and based on the area of the pixel covered, determining a shading value for the pixel by interpolating between the shade of said line segment and the shade of the background; and

displaying on the output device the reduced-aliased line segment;

wherein, when a first edge along said line segment and a second edge orthogonal to said line segment traverse a partially covered pixel, the step of determining the area of the partially covered pixel includes:

computing a first area of the pixel not covered by the first parallel edge and subtracting the first area from one to form a first difference;

computing a second area of the pixel not covered by the second edge and subtracting the second area from one to form a second difference; and

forming a product of the first and second differences.

21. (Currently Amended) A method in a computer graphics system for rendering and displaying on an output device, having a finite number of pixels, a non-zero thickness line segment with reduced aliasing, comprising:

expanding an edge of the line segment touching but not covering a pixel center of the line segment to be rendered on the output device so that the expanded line segment covers the center of the pixel touched;

determining, using the pixel centers, the pixels to be included in the expanded line segment, the line segment being distinguishable from a background over which said line segment is rendered by having a shade different from a shade of the background; and

for each pixel that is included in said non-zero thickness expanded line segment, determining the area of the pixel partially or fully covered by said line segment, and based on the area of the pixel covered, determining a shading value for the pixel by interpolating between the shade of said line segment and the shade of the background; and

displaying on the output device the reduced-aliased line segment;

wherein, when two parallel edges and a third orthogonal edge of said line segment traverse a partially covered pixel, the step of determining the area of the partially covered pixel includes:

computing a first area of the pixel not covered by the first parallel edge;

computing a second area of the pixel not covered by the second parallel edge;

summing the first and second areas and subtracting the sum from one to form a first difference;

computing the third area of the pixel not covered by the third orthogonal edge and subtracting the third area from one to form a second difference; and

forming a product of the first difference and the second difference.

22. (Currently Amended) A method in a computer graphics system for rendering and displaying on an output device, having a finite number of pixels, a non-zero thickness line segment with reduced aliasing, comprising:

expanding an edge of the line segment touching but not covering a pixel center of the line segment to be rendered on the output device so that the expanded line segment covers the center of the pixel touched;

determining, using the pixel centers, the pixels to be included in the expanded line segment, the line segment being distinguishable from a background over which said line segment is rendered by having a shade different from a shade of the background; and

for each pixel that is included in said non-zero thickness expanded line segment, determining the area of the pixel partially or fully covered by said line segment, and based on the area of the pixel covered, determining a shading value for the pixel by interpolating between the shade of said line segment and the shade of the background; and

displaying on the output device the reduced-aliased line segment;

wherein, when two parallel edges and a third and forth orthogonal edge of said line segment traverse a partially covered pixel, the step of determining the area of the partially covered pixel includes:

computing a first area of the pixel not covered by the first parallel edge;

computing a second area of the pixel not covered by the second parallel edge; and

summing the first and second areas and subtracting the sum from one to form a first difference;

computing the third area of the pixel not covered by the third orthogonal edge;

computing the fourth area of the pixel not covered by the fourth orthogonal edge;

summing the third and fourth areas and subtracting the sum from one to form a second difference; and

forming a product of the first difference and the second difference.

23. (Canceled)

24. (Canceled)

25. (Canceled)

26. (Canceled)

27. (Canceled)

28. (Canceled)